

## AFRL supports Columbia accident investigation

by Grace Janiszewski, Sensors Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Air Force Research Laboratory scientists here helped uncover mysteries surrounding the Space Shuttle Columbia and crew loss earlier this year by trying to determine the flight day two object origin.

Although not able to determine exactly what the object was because it burnt up on re-entry, AFRL experts helped NASA officials sift through materials to eliminate a field of possible candidates.

Investigators reviewing automated space debris tracking radars shortly after the tragedy discovered that a mysterious object separated from the Columbia on its second day in space, “flight day two.” This piece became known as the “flight day two object.”

NASA experts said during previous shuttle flights, materials have occasionally drifted out of the payload bay, or individual tiles have come off on orbit. However, since a serious accident had obviously occurred, Columbia Accident Investigation Board members wanted to know what the “flight day two object” may have been, and whether it had any relationship to the tragic events that followed.

Dr. Brian Kent and Dan Turner, working with a team of engineers and technicians from AFRL’s Sensors Directorate, Radar Cross Section facility became part of an inter-governmental team charged with narrowing down the object’s identity. They worked with engineers from the Johnson and Kennedy Space Centers, U.S. Strategic Command and Peterson Air Force Base, Colo.

Since the object in orbit eventually decayed and burned up 60 hours after it was first observed, sensors team members said they knew two solid characteristics about the flight day two object: Its radar signature at several frequencies and its ballistic coefficient, or the area to mass ratio of the part. By using these two pieces of information, they said they could conduct tests and analyze external shuttle materials to help screen out candidates.

According to Kent, the first tests involved ordinary shuttle tiles, thermal blankets and thermal insulation materials. Radar signature tests performed on AFRL’s advanced compact range here initially screened out many of the first candidates NASA officials brought forward.

“Most of the low-density insulation blankets and tiles had an RCS that was orders of magnitude too low to be the flight day two object,” he said. “Still other materials, though of the right radar signature, were far too light to match the area to mass ballistic characteristics.”

During a 70-day testing period that began in March, different shuttle materials were shipped to Wright-Patterson and tested in more than 41 configurations, according to Kent.

In addition to providing critical support in identifying the flight day two object, sensors team members provided radar signature data taken at various FAA frequencies, as well as the ascent tracking frequencies that NASA used to assist in the shuttle debris recovery efforts.

“Everything onboard the shuttle was considered for the day two object — from the wrench in the payload bay to the carrier panels that are bolted to the wings’ leading edge as protection against the hot temperatures,” Kent said. “My team worked tirelessly with more than 1,000 man-hours logged in the pursuit of the answers.”

Kent said he and his team worked closely with engineers from NASA who separately analyzed the ballistic qualities of all materials tested. In order for an item to be considered as a candidate for the flight day two object, it had to match the radar signature Kent’s team tested as well as the known ballistic characteristics U.S. Strategic Command experts developed.

Finally, forensic evidence from the debris hanger was used to further screen candidates, Kent said. If the suspect part was recovered, it could not be the flight day two object.

“Obviously, the object burned up on re-entry, so it’s impossible to definitively know what the flight day two object was,” Kent said.

The CAIB will issue its final report to Congress late August, detailing the most probable cause of the Shuttle’s demise.

(To learn more about the Columbia investigation, visit [www.caib.us](http://www.caib.us) <<http://www.caib.us/>> .) @